Motion Effects on Intrusion Development

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Abstract

Analogue studies on intrusion development have found that visuospatial tasks performed during the encoding of aversive information reduce subsequent intrusion development. However, these studies cannot rule out a physical explanation in terms of simple movement. In the current study we addressed this issue. Healthy participants viewed an aversive film while performing a visuospatial movement task, a configurational movement task, or no task. Intrusive images from the film were reported in a diary during the week following film viewing. In line with an information processing account of post-traumatic stress disorder, intrusion frequency was significantly reduced by the visuospatial movement task but not the configurational movement task compared to no task. This finding supports the role of visuospatial processing specifically in intrusion development.

Keywords: Intrusions, Information processing, Motion, Trauma film

Motion Effects on Intrusion Development

Intrusive images can be defined as images of a traumatic event that come into mind uncontrollably. Intrusive images in post-traumatic stress disorder (PTSD) are mainly of a visual nature (Speckens, Ehlers, Hackmann, Ruths, & Clark, 2007), and visuospatial processing is thought to play a critical role in intrusion development. The dual representation theory (Brewin, Dalgleish, & Joseph, 1996) states that intrusion development depends on the balance between peri-traumatic visuospatial and verbal-conceptual processing. During extreme stress, information processing shifts towards more visuospatial processing, resulting in image-based trauma representations that are prone to automatic intrusive activation (Holmes & Bourne, 2008).

Experimental studies show that performing a visuospatial task (e.g., complex pattern tapping) during the encoding of an aversive film reduces subsequent intrusion frequency (Brewin & Saunders, 2001; Holmes, Brewin & Hennessy, 2004; Stuart, Holmes & Brewin, 2006). However, movement per se is confounded with the visuospatial aspect in these studies. Hagenaars, Van Minnen, Holmes, Brewin, and Hoogduin (2008) found that participants who were instructed not to move during an aversive film reported more intrusive images after one week compared to participants who could move freely. This gives rise to the idea that movement per se could have the reverse effect. A critical test is needed of the effects of visuospatial versus non-visuospatial movement on intrusion development.

Configurational movements by definition rely on *propriospatial* information and *not* on visuospatial processing. Smyth, Pearson and Pendleton (1988) found that performing a visuospatial tapping task interfered with visuospatial recall but not with movement recall.

Conversely, configurational movement tasks (continuously tapping body parts with the hands, hand squeezing) interfered with configurational but not visuospatial recall (Smyth et al., 1988; Smyth & Pendleton, 1989).

In terms of suitability for the current study, the body tapping task in Smyth et al. (1988) could interfere with film viewing, the squeezing task used by Smyth and Pendleton (1989) might affect heart rate which is related to intrusion development (Holmes et al., 2004). Therefore, we chose a complex chewing gum task. This involved chewing the gum from the left jaw to the front teeth, the right jaw, the left jaw and back again continuously. This task does not interfere with film viewing, is unlikely to have a significant effect on heart rate and involves propriospatial but not visuospatial imagery. Research on infant imitation behaviour supports the idea that tongue movements rely on a proprioceptive system and not on visuospatial processing (Meltzoff & Moore, 1983a; Meltzoff & Moore, 1983b; Meltzoff & Moore, 1989).

We also included measures of dissociation and cognitive avoidance in this study. Dissociation is described as “a disruption in the usually integrated functions of consciousness, memory, identity, or perception” (American Psychiatric Association, 2000, p. 519). Retrospective (e.g., Ozer, Best, Lipsey, & Weiss, 2003) and prospective studies (Engelhard, Van Den Hout, Kindt, Arntz, & Schouten, 2003; Murray, Ehlers, & Mayou, 2002) have shown that dissociation is related to intrusion development, and that dissociation can be induced by an aversive film (Brewin & Saunders, 2001; Holmes et al., 2004).

The main goals of the present study were: (a) to replicate the finding of lower intrusion frequency from a concurrent visuospatial task (complex pattern tapping) during the encoding of an aversive film, and (b) to distinguish between the effect of visuospatial versus non-visuospatial movement on intrusion development using a configurational task. Based on an information processing account of PTSD (Brewin et al., 1996; Holmes & Bourne, 2008), we expected that the visuospatial task would results in lower intrusion frequency than both no task and the configurational task, which should not affect intrusion frequency compared to no task. If both movement tasks reduce intrusion frequency compared to no task, this would count against the special role of visuospatial processing in intrusion development as stated by the dual representation theory (Brewin et al., 1996; Holmes et al., 2004).

Method

Participants

Participants, all psychology students, were recruited on university campus by flyers and posters. As required by the ethical committee (CMO approval number 2005/063), these contained information about the violent nature of the film. Participants received € 24 for participation. Exclusion criteria were: panic attacks, panic disorder, PTSD, major depressive episode (current and lifetime), blood phobia, history of fainting, and road traffic accidents (RTA). There was no drop-out. Data of 54 participants was collected (34 women, 20 men). The average age was 21 years and 9 months (*SD* = 3 years and 10 months). Age and gender were comparable across conditions.

The visuospatial tapping task, mood questionnaire, attention rating, cued-recall and recognition memory tests, diary compliance rating, and intrusion diary were the same as in Holmes et al. (2004). All questionnaires were presented on a PC using Perseus® software (Version 6).

Materials

Aversive film. The film contained four scenes of the aftermath of real-life RTAs showing car wrecks, bloody wounds, and dead bodies being moved (Steil, 1996; Hagenaars et al., 2008). The film was projected onto a smooth white wall and sound was presented through headphones.

Experimental tasks. A 5 x 5 matrix keyboard with letters running from *A* to *Y* ("Moar box") was used for the visuospatial tapping task. Participants continuously tapped the complex pattern *JYPVA* as fast and accurately as possible during the film while the tapping hand was out of sight. For the configurational task, participants chewed sugar free gum (peppermint flavour). Participants in the visuospatial and the configurational movement condition practiced the task for one minute before the film. All participants were instructed to view the film as if they were witnesses, not to look away and to pay full attention to the film. To enhance task compliance participants were told that they were videotaped (a recording was not actually made).

Measures

Emotional impact of the film. A mood questionnaire was used to rate current happiness, fear, horror, depression and anger on a 0 - 10 point scale (0 = not at all, 10 = extremely). The Dutch version of the State-Trait Anxiety Inventory (Van der Ploeg, 1980) was used to assess state anxiety (STAI-S). It contains 20 items about the current level of anxiety, with ratings from 1 (almost never) to 4 (almost always). The STAI has satisfactory reliability and validity (Van der Ploeg, 1980).

Dissociation. Trait dissociation was measured with the Dutch version of the DES-II (Dissociative Experiences Scale – revised; Bernstein & Putnam, 1986). The DES-II consists of 28 items, and rates the frequency of dissociative phenomena on an 11-point scale with a 10% interval from 0% (never) to 100% (always). It has satisfactory reliability and validity (Bernstein & Putnam, 1986; Van IJzendoorn & Schuengel, 1996). State dissociation was measured with the Dutch version of the self report-DSS (Dissociative States Scale; Bremner et al., 1998). It contains 19 items rating current dissociative phenomena on a 5-point scale from 0 (not at all) to 4 (very much). Reliability and validity are sufficient (Bremner et al., 1998).

Attention and memory for the film. Attention was rated on an 11-point scale (0 = not at all focused on the film, 10 = attention completely focused on the film) as an indirect measure of task difficulty. The cued-recall memory test contained two to four open-ended questions per scene (for example: “What body parts were wounded and bleeding when the woman was freed from the minivan and was lying down on the stretcher?”). The recognition memory test contained three to five statements per scene (for example, “The paramedics covered the students’ head with bandage” yes/no).

Compliance and demand. Diary compliance was rated on a scale from 0 (never forgot to write down the intrusion) to 10 (always forgot to write down the intrusion). Participants were asked about the perceived goal of the study with an open-ended question.

Cognitive avoidance. A single-item question (“During the last week, how strongly have you tried to push away or supress thoughts and images of the film?”) was rated on a 7 point scale (1 = not at all, 7 = very strongly). The item correlates highly with the avoidance subscale of the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979), $r = .62$, $p < .001$ (Krans, Näring, Holmes, & Becker, 2008) and smilar one-item avoidance measures have been used in previous research (e.g., Becker, Rinck, Margraf, & Roth, 2001).

Intrusive images. These were recorded in a one-week diary. Participants indicated whether the intrusion was an image, verbal thought, or both, and provided a content description. Participants were required to check their entries at a fixed time every day.

Procedure

After signing informed consent, participants filled in a demographic questionnaire (age, gender, and education), the DES-II, the DSS, the STAI-S and the mood questionnaire. Then, participants received instructions according to condition and practiced their task for one minute. Participants were told they could quit the experiment at any time. Participants viewed the film and then filled in the DSS, the mood questionnaire, the STAI-S and the attention rating. During the week between the first session and follow-up, participants reported their intrusions of the film in the diary. At follow-up they filled in the cued-recall and the recognition memory test, the diary compliance rating and an open-ended question on the goal of the study. The participants were debriefed, paid and thanked for participation.

Method of analysis

For variables that showed a violation of homogeneity of variance according to Levene's statistic, the corrected t-value is reported. A priori hypotheses were examined with directional tests. The number of intrusive images did not have a normal distribution so Spearman correlations were used. For all analyses, an alpha of .05 was the level of significance. Descriptive statistics are reported in Table 1.

Results

Outliers and task compliance

The diary data were checked for outliers (more than three standard deviations from the mean) using boxplots. One multivariate outlier (in the visuospatial tapping condition) was removed from the dataset. One univariate outlier was changed into one unit smaller than the next extreme score in that condition (Tabachnick & Fidell, 1996).

The average number of tapped keys and correct sequences were compared to those reported in Holmes et al. (2004; Experiment 1) with two one-sample *t*-tests. These showed comparable performance (both $p > .05$).

<u>Table 1 about here</u>

Control measures

Emotional impact. A mixed analysis of variance (ANOVA) was done with the mood questionnaire and STAI-S as the within-subject factors and condition (control, visuospatial tapping, configurational chewing gum) as the between-subject factor. The overall within-subject effect was significant, $F(6, 46) = 13.53$, $p < .001$, $f = 1.33$, and all univariate within-subjects effects were significant (all $p < .05$), indicating a significant emotional impact of the film. There was no significant effect of condition or a significant interaction effect (both $p > .05$).

Dissociation. A 2 (pre-film versus post-film) x 3 (condition: control, visuospatial tapping, configurational chewing gum) mixed ANOVA with state dissociation as the dependent variable showed a significant increase from baseline to post-film, $F(1, 51) =$

4.06, $MSE = 6.31$, $p = .05$, $f = 0.27$. There was no significant effect of condition ($p < .05$) and no significant interaction effect ($p < .05$). Trait dissociation and state dissociation (pre-film, post-film, and change) were not significantly correlated with intrusion frequency (all $p > .05$).

Attention and memory. A one-way ANOVA showed no significant difference between the conditions with regard to the attention rating for the film, $F(2, 51) = 1.48$, $MSE = 1.51$, $p = .24$, indicating that the tasks were comparable on required attention and task difficulty.

A one-way ANOVA showed a significant difference between on the cued-recall memory test, $F(2, 51) = 4.40$, $MSE = 3.25$, $p = .02$, $f = 0.42$. Post hoc tests with Bonferroni correction showed a significantly better cued-recall performance in the no-task control condition, $M = 7.00$, $SD = 1.56$, compared to the visuospatial tapping condition, $M = 5.19$, $SD = 2.34$, $SE = .61$, $p = .01$. There was no significant difference between the configurational chewing gum condition, $M = 6.21$, $SD = 1.47$, and either other condition (both $p > .05$). Across conditions cued-recall performance was positively related to intrusion frequency, $r_s = .35$, $p = .01$. A one-way ANOVA showed that recognition memory performance was comparable across conditions, $p > .05$.

Cognitive avoidance. A one-way ANOVA showed no significant difference between the conditions with regard to cognitive avoidance at follow-up, $p < .05$. There was no significant correlation with intrusion frequency, although there was a trend in the predicted direction, $r_s = .24$, $p = .08$, with more avoidance related to more intrusions.

Demand characteristics. None of the participants mentioned modulation of intrusion frequency by the two movement tasks when asked for the goal of the study.

Intrusion modulation

As predicted, participants in the visuospatial tapping condition reported significantly fewer intrusive images of the film, $M = 1.64$, $SD = 1.86$, compared to the no-task control condition, $M = 4.28$, $SD = 4.79$, corrected $t(24.09) = 2.21$, $p = .02$ (one-tailed), $d = 0.78$, and the configurational chewing gum condition, $M = 2.63$, $SD = 1.61$; $t(33) = 1.70$, $p = .05$ (one-tailed), $d = 0.57$. The difference between the configurational chewing gum condition and the no-task control condition was not significant, corrected $t(21.99) = 1.42$, $p = 0.17$ (two-tailed).

We performed a hierarchical regression analysis to see whether cued-recall contributed to the prediction of intrusive images independently of experimental condition. The first block contained two dummy variables representing experimental condition. The second block contained the cued-recall memory test. The first block reached significance, $F_{change}(2, 51) = 3.13$, $p = .05$, $R^2_{change} = 0.11$. The second block did not increase the prediction significantly, $p < .05$. Thus, the cued-recall memory performance did not predict intrusive images after controlling for experimental condition.

Discussion

We aimed to replicate the finding that a visuospatial task performed during encoding protects against intrusion development after an aversive film. We investigated whether visuospatial movement specifically or movement in general reduces intrusion development. Our results showed that the visuospatial tapping task reduced intrusion frequency compared to both the no-task control condition and the configurational chewing gum condition, whereas the latter did not reduce intrusion frequency compared to no task. Attention or task difficulty did not seem to explain this difference. Our findings support an information processing account of PTSD (Brewin et al., 1996; Holmes & Bourne, 2008). Although it has been found that non-movement is related to an increase in intrusion frequency (Hagenaars et al., 2008), our results do not support an opposite effect. Interestingly, performance on the cued-recall memory test at one week was positively related to the number of intrusive images. This fits an explanation in which the visuospatial tapping condition reduces visuospatial encoding, affecting both intrusion frequency and deliberate recall.

With regard to dissociation, our results replicated the finding by Holmes et al. (2004) that an aversive film can induce spontaneous dissociation. However, our effect was modest at best. Neither state nor trait dissociation was related to the number of intrusive images in our study. Perhaps only higher levels of dissociation lead to intrusion development, and this was not induced in this analogue experiment.

The use of concurrent tasks in order to reduce intrusive images has also been endorsed by EMDR research. In a comprehensive series of experiments, Gunter and Bodner (2008) showed that vividness and emotionality of the memory decreased according to the cognitive load of the task, regardless of modality (visuospatial and verbal). This seems to contradict our present argumentation on a modality specific effect of visuospatial processing. However, an important difference is that our study focused on *encoding* processes whereas EMDR focus on *recall* of traumatic memories. A systematic study of modality (a)specific effects on intrusive memories directly comparing encoding and recall processes has not been done yet and would be an interesting future direction.

The present study has some specific limitations. The chewing gum task was created on the basis of literature of configurational and proprioceptive movement but we did not specifically test the assumption that it is not a visuospatial task. This leaves open the possibility that it may involve a visuospatial component after all, although our findings and previous research do not support this. Further, we did not control for several measures that are thought to be related to intrusion development, such as repressive coping, neuroticism, and schizotypy. Avoidance was measured with a single-item instead of a validated measure, for example the IES (Horowitz et al., 1979).

In sum, our results suggest that it is not movement per se but visuospatial movement specifically that reduces intrusive images after viewing an aversive film. This important finding confirms a central tenet of information processing theories of PTSD (Brewin et al., 1996) which suggest that perceptual processing, rather than movement per se, underlies the intrusion development.

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Table 1

Descriptive statistics for each experimental condition

Measure	*No task* *M*	*SD*	*Visuospatial tapping* *M*	*SD*	*Configurational chewing gum* *M*	*SD*
Total key presses	-	-	807.19	404.99	-	-
Correct sequences	-	-	148.31	62.67	-	-
Intrusion frequency	4.28	4.79	1.64	1.86	2.63	1.61
Happiness: pre-film	7.47	1.31	8.13	0.72	7.95	0.85
post-film	5.47	1.87	6.38	1.75	5.89	2.21
Anxiety: pre-film	1.89	1.41	2.13	1.41	1.89	1.41
post-film	2.11	1.60	3.38	2.36	2.58	2.01
Horror: pre-film	1.16	0.50	1.63	0.89	1.05	0.23
post-film	2.89	2.18	4.63	2.78	4.00	2.94
Depressed mood: pre-film	1.58	0.61	1.88	1.03	2.00	1.53
post-film	2.89	2.05	4.00	1.93	3.26	2.51
Anger: pre-film	1.16	0.38	1.69	1.01	1.21	0.54
post-film	1.32	0.95	2.63	2.25	2.37	2.31
State anxiety (STAI-S): pre-film	31.68	5.97	30.31	5.88	31.53	7.31
post-film	36.63	6.92	37.50	8.85	36.11	9.67
State dissociation (DSS): pre-	21.00	1.83	21.44	3.24	21.95	3.01

film						
post-film	21.74	3.46	23.00	7.27	22.58	2.97
Trait dissociation (DES-II)	4.72	3.07	5.02	4.04	6.62	3.98
Attention	8.68	1.06	8.13	1.20	8.05	1.39
Cued-recall	7.00	1.56	5.19	2.34	6.21	1.47
Cued-recognition	11.47	1.90	10.81	1.60	11.00	1.86

Note: Dashes stand for ‘not applicable’.